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ABSTRACT

It has been argued from world view theory that fundamental beliefs abut the world exert a powerful influence on how sense is made of events in the world. However, the nature of that influence has remained enigmatic. Hannah Arendt's distinction between thinking and comprehension, and knowing and apprehension provides a clarification. Thinking is the epistemological path to conceptual comprehension. Knowing is the metaphysical path to apprehension-to the acceptance of a concept as true or valid. Comprehension does not necessitate apprehension. One may reject a fully understood concept. The recent discussion in science education about world view is essentially a discussion about metaphysics. The importance to educational practice is this: Science educator's are often at a loss to understand why some students fail to develop orthodox scientific conceptions even after the best of instruction. The argument from world view is that in some cases, it is not that the students fail to understand what is being taught (comprehension), they simply do not believe (apprehension). There are, thus, occasions when the careful epistemological explication of a concept is not sufficient to bring about learning. Instruction must also include a discussion of the metaphysical foundations that support epistemology. A model of the relationship between world view and conceptual change is included. Contains 20 references. (Author/MDH)

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World View, Metaphysics, and Epistemology

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Working Paper No. 106

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Abstract

WORLD VIEW, METAPHYSICS, AND EPISTEMOLOGY
William W. Cobern, Arizona State University West

It has been argued from world view theory that fundamental beliefs about the world exert a powerful influence on how sense is made of events in the world. However, the nature of that influence has remained enigmatic. Hannah Arendt's distinction between thinking and comprehension, and knowing and apprehension provides a clarification. Thinking is the epistemological path to conceptual comprehension. Knowing is the metaphysical path to apprehension - to the acceptance of a concept as true or valid. Comprehension does not necessitate apprehension. One may reject a fully understood concept. The recent discussion in science education about world view is essentially a discussion about metaphysics. The importance to educational practice is this. Science educators are often at a loss to understand why some students fail to develop orthodox scientific conceptions even after the best of instruction. The argument from world view is that in some cases, it is not that the students fail to understand what is being taught (comprehension). They simply do not believe (apprehension). There are, thus, occasions when the careful epistemological explication of a concept is not sufficient to bring about learning. Instruction must also include a discussion of the metaphysical foundations that support epistemology.

Introduction

In other papers on world view theory (1991; 1993; in press), I have argued the importance of fundamental beliefs with respect to learning science and the development of scientific attitudes. The argument is both intuitively and rationally strong that fundamental beliefs about the world exert a powerful influence on how sense is made of events in the world. However, the nature of that influence has remained enigmatic, thus limiting the application of world view theory to educational practice. Hannah Arendt's (1978) distinction between thinking and comprehension, on the one hand, and knowing and apprehension on the other, provides the basis of a possible clarification. In this presentation, I will briefly discuss how the linkage between world view (the level of metaphysics) and conceptual change (the level of epistemology) can be developed from Arendt's work on metaphysics and epistemology. I am not so naive as to think that this will settle the linkage issue once and for all. I claim only to be making a thoughtful contribution to the discussion.

The Problem

The 1991 NARST monograph on world view theory (Cobern, 1991) provided a much needed clarification of the concept of world view. The monograph contributed to the discussion on how culture relates to science learning (e.g., Gallard, 1992). It provided a theoretical framework from which researchers can derive questions for study (Cobern, in press; Lassiter, 1992). The monograph, however, did not offer an adequate explication of the linkage between world view and conceptual change.

Figures 1 and 2 illustrate a *general* relationship between world view and conceptual levels of thought (Figures 1-3 are from the monograph). Figure 1 is Gowen's Knowledge Vee

which Novak has successfully used to show that epistemology has levels, the most general of which is world view. The purpose of Figure 2 is to emphasize the role world view has as a foundation for epistemology, whether it is the epistemology of informal commonsense or of formal scientific thinking. Figure 3 is an attempt to show more specifically the relationship between the alternative conceptions and misconceptions of science, and world view. The thrust is that a scientifically invalid conception can be valid on other grounds. The critical factor is how one chooses to make sense of the world. But, the question remains, "what do the lines connecting world view with the conceptual level of thought actually mean?" Moreover, and since research is supposed to support the improvement of science education (Yeany, 1992), what can this vague connection mean for the classroom practitioner? Seeking to offer further clarification, I borrowed Berger's (1979) notion of "plausibility structure," that is, a world view is what makes things plausible to a person (see Cobern, 1991, pp. 113-116). However, this too is an insufficiently answer. After all, what does it mean - in practical terms - to make something plausible? We must know more about the nature of the *working* relationship between world view and scientific knowledge (or for that matter, any knowledge) if we are to realize the full potential of world view theory.

The Solution

Science educators have long assumed that the case for the importance and validity of scientific knowledge was *prima facie*. This assumption rested on the philosophy of logical positivism which essentially claimed that only scientific knowledge was true knowledge. Smolicz & Nunan (1975) refered to this as the mythology of school science. Nevertheless, virtually all science teachers have had the unsettling experience of explaining a scientific concept with great

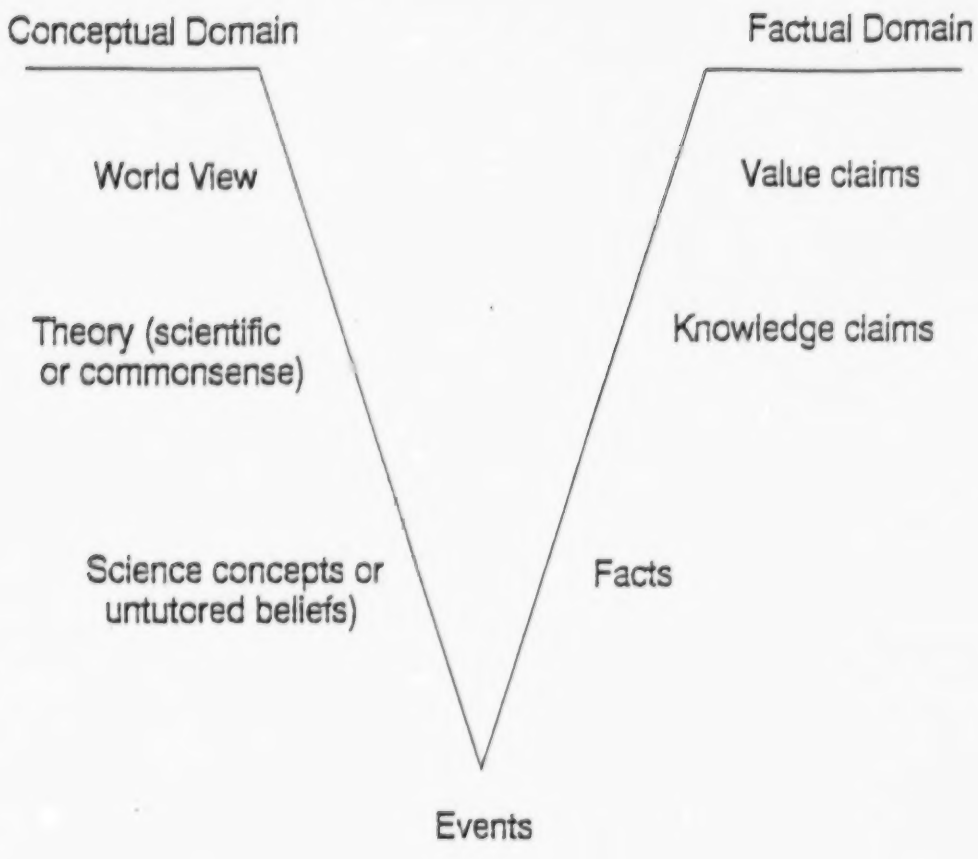

Figure 1. Gowin's Knowledge Vee: Science and Commonsense
(From Cobern, 1991, p. 8)

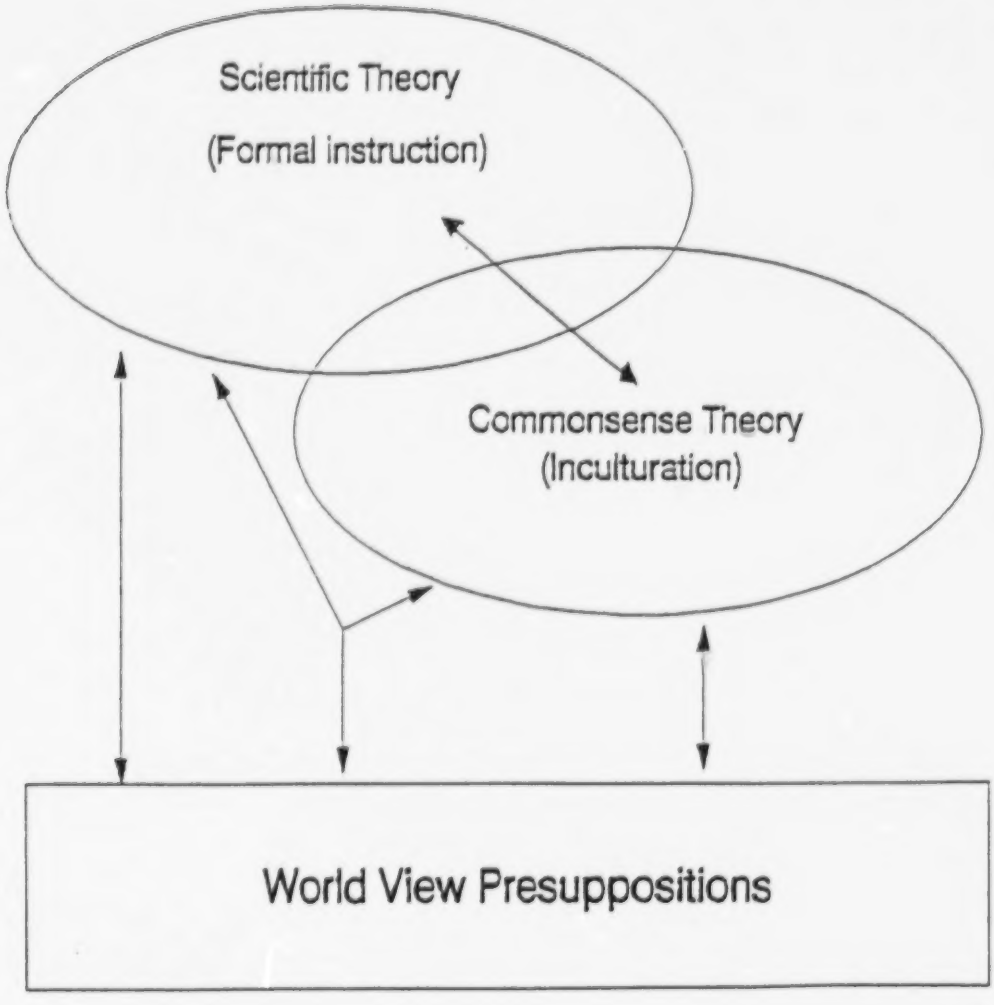

Figure 2. Science Theory, Commonsense, & World View
(from Cobern, 1991, p. 9)

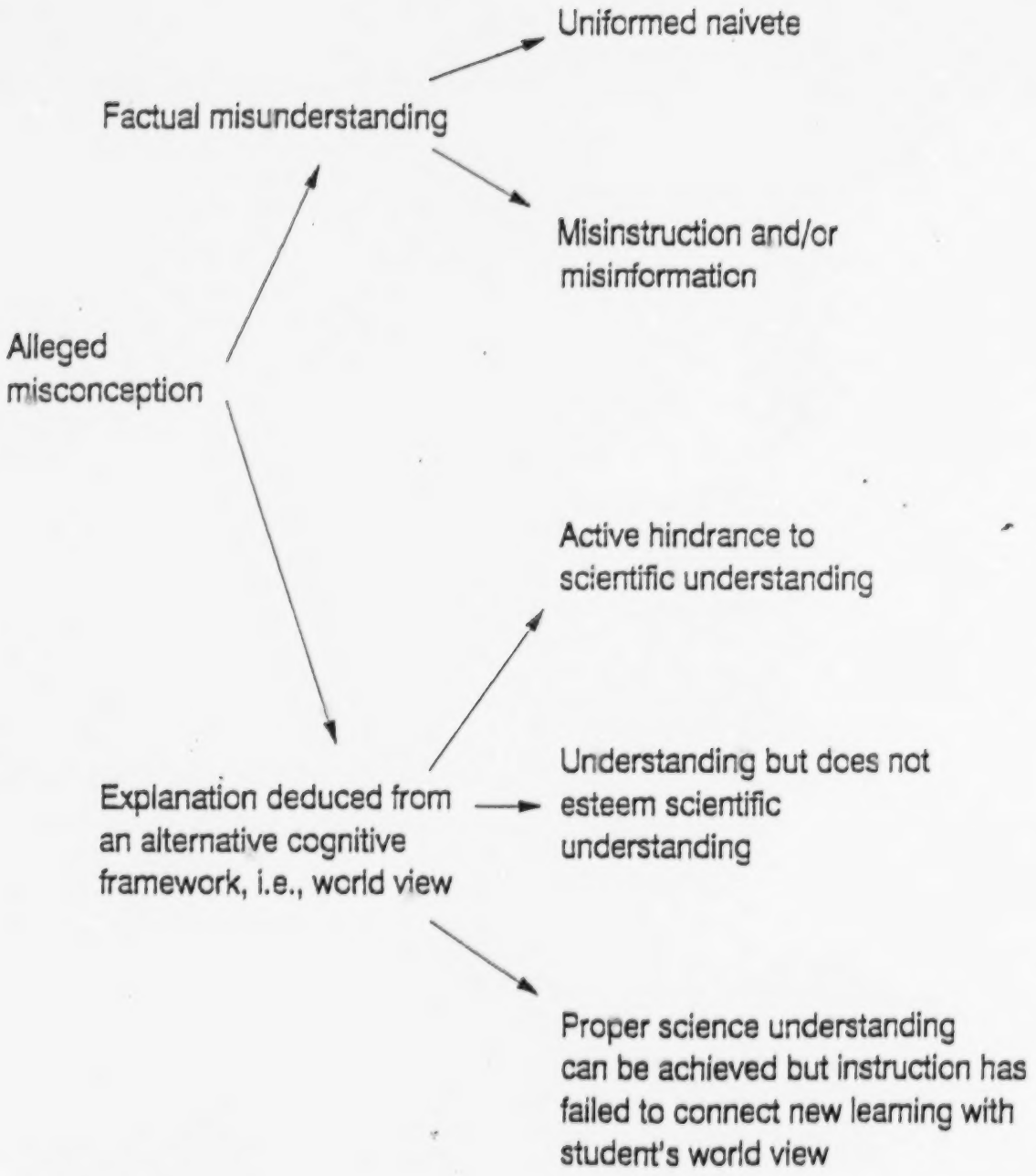
Uniformed naivete
Factual misunderstanding
Misinstruction and/or misinformation
Alleged misconception
Active hindrance to scientific understanding
Understanding but does not esteem scientific understanding
Explanation deduced from an alternative cognitive framework, i.e., world view
Proper science understanding can be achieved but instruction has failed to connect new learning with student's world view

Figure 3. Root Analysis of an Alleged Misconception
(from Cobern, 1991, p. 95)

care and skill only to have a student dismiss the concept virtually out of hand. At best, the positivist science teacher reacted by saying there must be yet a better way to teach the concept. At worst, the teacher assumed the student was either very foolish or had been indoctrinated by purveyors of anti-science. After all, the teacher is presenting *scientific facts*. The community of science educators is now painfully aware of how very few laypeople ever accepted the positivistic faith.

In recent years, constructivist thought has elbowed aside positivism. A consistent constructivist teacher cannot react in the same way to the recalcitrant learner. The constructivist teacher knows that all knowledge entails ambiguity. There are no unambiguous facts. There are no determined theories. So, if scientific concepts do not have an inherent certainty, the consistent constructivist must eventually ask what are the principles on which validity or truth is decided. Some constructivists eschew metaphysical questions (von Glasersfeld, 1989). In doing so they show themselves to be *trivial* constructivists because they do not follow the constructivist argument to its natural conclusion - why do we believe what we do? Constructivism has resurrected the ancient idea that *knowledge* is valid or true *belief*, and it is with this idea that we can begin to understand how world view directly influences conceptual development and change.

Hannah Arendt (1978) noted that an argument can be rationally flawless. The interpretation of data can be epistemologically perfect. And yet, some will reject the conclusions. The reason, she argued, is the fundamental difference between thinking and knowing (see Figure 4). Thinking is necessary for knowledge, but not sufficient. Thinking is the epistemological process by which one comes to conceptual comprehension. Knowing is the

metaphysical process by which one comes to apprehend, that is to accept as true or valid, that concept one has come to comprehend. However, comprehension does to necessitate apprehension. One may well reject a concept that is fully understood. Moreover, in many situations the metaphysical process occurs reflexively. In philosophy, metaphysical debate has long been out of fashion, but in education, the recent discussion about world view is essentially a discussion about metaphysics.

Science educators need not be at a loss to understand why some students fail to develop orthodox scientific conceptions even after the best of instruction. The argument from world view is that in some cases, it is not that the students fail to comprehend what is being taught - it is that they simply do not believe it. Therefore, there are occasions when the careful epistemological explication of a concept is not sufficient to bring about learning. The instruction must also include a discussion of the metaphysical foundations that support the epistemology.

Significance

Once again scientific literacy is at the forefront of national discussions on education. Project 2061 is about scientific literacy. It and other reform movements are a response to international studies showing science education in the USA lagging behind other countries. However, as Olson recently noted,

> those studies are not measuring literacy - they are measuring retention of pieces of scientific information whose utility is questionable. What we have to ask... is what we mean by literacy? [Rather], scientific literacy must mean the same as literacy itself: getting around in the world, making meaning, and deciding how to act. The science you learn has to work in situations of ambiguity, value conflict, change, corporate

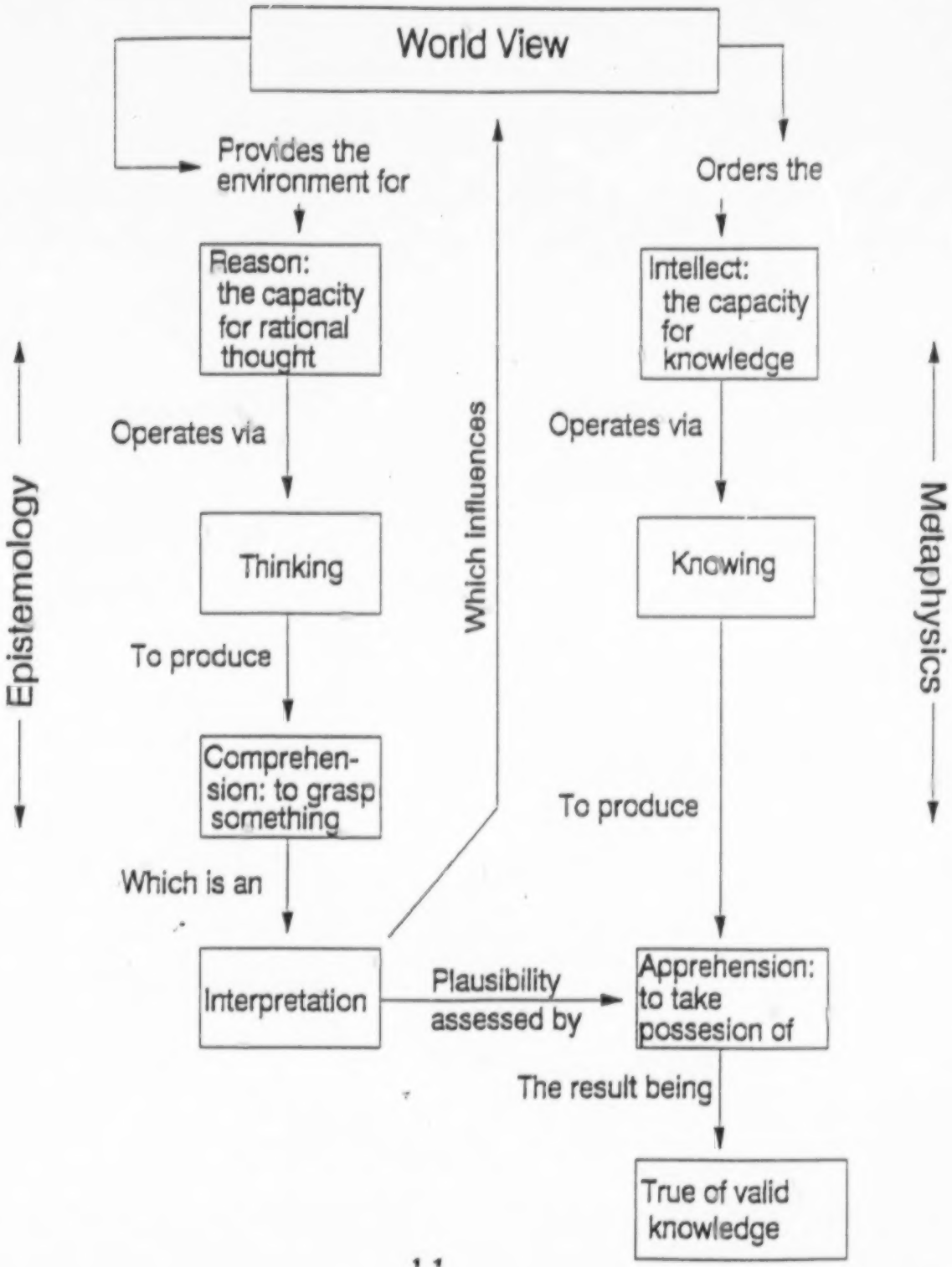

Figure 4. World View and Conceptual Change

manipulation, and distraction. It is a tough world out there as they say. (1992, p. 7)

Olson is supported by a recent study showing that after completing several college science courses, many of the students still had not integrated scientific knowledge into their views of what the natural world is really like (Cobern, in press).

An adequate theory of world view gets one beyond simplistic views of scientific literacy. It gets the profession beyond the bureaucratic and social engineering ethos that says successful science teaching is a matter of having the right *techniques*. *Technique* can show an argument to be reasonable. It cannot convince anyone that the conclusion is plausible or meaningful. I concur with Lythcott (1991, p. 47, emphasis added), "In negotiating meaning a science teacher weights the conversation toward *listening* to the learners and enabling them to find their voices." As of now we have only poorly formed ideas of what these issues of world view and metaphysics mean for classroom practice. However, the theoretical work implies that for the majority of students, if they are not allowed to do metaphysics there appears to be little chance that long term conceptual change will take place. Students will learn for the exam, but in the long run they will revert to what makes sense to them - which, as we know, is not science.

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